Burned Area Emergency Rehabilitation Efforts Following the Cerro Grande Fire, New Mexico

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ABSTRACT

In May 2000, the Cerro Grande Fire burned over 43,000 acres of forest on Bandelier National Monument, Santa Fe National Forest, Santa Clara Pueblo, San Ildefonso Pueblo, Los Alamos County, and the Los Alamos National Laboratory (LANL). An Interagency Burned Area Emergency Rehabilitation (BAER) Team was formed to evaluate the extent of the disturbance and prescribe treatments. The LANL Emergency Rehabilitation Team (ERT) was formed to prescribe and implement treatments on LANL property. One of the primary objectives of the emergency rehabilitation effort was to protect on-site and downstream resources from the effects of postfire erosion and storm water runoff while promoting ecosystem recovery. Treatments were used to stabilize soils and retain water on moderately and severely burned hill slopes.

INTRODUCTION

The forests surrounding Los Alamos New Mexico (Figure 1) suffer from a problem common to many forests of the Western US. Historically, fires were frequent and of low intensity and generally burned only the understory vegetation. However, after over 100 years of fire suppression, tree densities and fuel loads are unnaturally high. Under the appropriate conditions, wildfires now kill mature trees, consume all surface organic matter and leave soils bare and hydrophobic. Such conditions occurred in May 2000 when the Cerro Grande Fire burned through the forest surrounding Los Alamos, New Mexico (Figure 2).

Flooding and erosion were determined to be the greatest risks because of the severity of the fire, steep slopes, hydrophobic soils, and the concern that the summer thunderstorm season was fast approaching. Emergency actions were taken by the Interagency BAER Team and the LANL ERT to stabilize soils and control runoff.

Figure 1

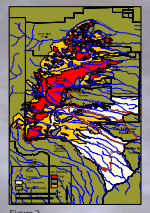
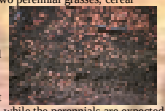


Figure 2

METHODS

Seeding
All areas of moderate or high burn severity were aerially seeded (Figure 2). The seeding mixture consisted of two annual grasses and two perennial grasses, cereal barley, annual ryegrass, slender wheatgrass, and mountain brome respectively. The annual grasses were intended to provide a rapid cover response that will die out within two to three years while the perennials are expected to persist for up to ten years. Seed was applied at a rate of approximately 36 lbs/ac (40 kg/ha) or 60 seeds/ft² (650 seeds/m²).

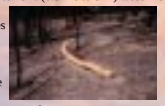


Contour Raking
Over 600 acres (243 ha) of burned areas were identified as having a high risk of flooding residential neighborhoods. In these high-risk areas, soils were raked along the contour to break up the hydrophobic layer and then hand seeded and mulched with straw. Much of this work was conducted by community volunteers.

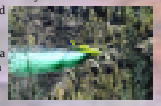
Straw Mulch
Straw mulch was applied throughout the moderate and severely burned areas. Certified weed-free straw was applied at a minimum of 2,000 lbs/acre (2,240 kg/ha) or approximately 2 in. (5 cm) deep. The area was generally hand seeded before mulch was applied.

Log Erosion Barriers and Contour Felling
Log erosion barriers were used when 8–12 in. (20–30 cm) dbh logs were available on moderate slopes (40%–60%) with less than 60% surface rock. Trees were felled across the slope and limbed to increase soil contact. The ends of the logs were secured with stakes or behind stumps, and a trench dug on the uphill side of the log to increase sediment storage capacity. Contour felling is less time consuming but also less effective. Smaller dbh trees (6–14 in.[15–35 cm]) were felled across the slope and limbed. Density of either treatment ranges between 20–40 ft (6–12 m) between logs and is dependent upon the slope and the availability of appropriate sized trees.

Straw Wattles
Wattles are 12-in.× 20 to 25-ft (0.3× 6 to 8-m) weed-free straw rolls wrapped in plastic netting. Wattles are laid in shallow trenches along the contour and staked to assure contact with the soil. The upslope side can be trenched to increase sediment storage capacity. Wattle density ranges from 20–60 per acre (50–150 per ha) depending on slope and burn severity.



Hydromulching
Areas of greater than 70% slope were determined to be too steep for field crews to work safely. Some of these areas were aerially hydromulched with a mixture of seed, mulch and tackifier. Hydromulch also contains a green dye so that pilots can see the applications from the air.



RESULTS

Approximately 5,100 acres (2,064 ha) of burned area received hill slope treatments (Figure 3). Table 1 shows the estimated hydrologic effects of the individual treatments for one and two years postburn. Even by combining treatments, the greatest potential reduction in runoff was approximately 50% (BAER 2000). Hydrologic models projected that discharge from some of the burned watersheds would increase from a preburn estimate of 5 ft³/s (509 m³/ h) to over 500 ft³/s (51,000 m³/h) for a 25 yr storm (LANL 2000). Even if the entire watershed was treated, discharge would greatly exceed preburn levels and downstream resources would remain at risk.

In the field, some germination of applied seed was observed by the end of the growing season, but cover on burned areas was generally low (Photo 1). Areas mulched with straw had greater seed germination success than non-mulched areas. The mulching prescription on this fire called for no more than 2 in. (5 cm) of straw on the soil surface, in part due to the belief that more mulch would suppress seed germination. However, some areas received 6 in. (15 cm) or more and these areas showed the greatest seed germination. Although these areas looked good last fall, the long-term effect of the mulch on nitrogen availability and native seed suppression is unknown. Evidence of sediment storage behind wattles, log erosion barriers, and contour-felled logs was apparent throughout the burned area (Photo 2).

Table 1. Soil loss reduction factors for treated areas for the first two years after the fire (BAER 2000).

Treatment*	Upland Erosion % Reduction Year 1	Upland Erosion % Reduction Year 2
Grass Seeding	10	40
Contour Raking	30	30
Straw Mulching	15	5
Log Erosion Barriers	10	10
Contour Felling	5	10
Low Density Straw Wattles	15	15
High Density Straw Wattles	15	15
Hydromulch	15	5

*Note that the effect of multiple treatments is not additive. Estimations of the % runoff reduction for multiple treatments assumed that the most effective treatment had the full percentage reduction and subsequent treatments had 50% of their full effectiveness.

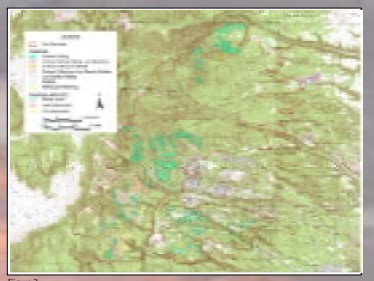


Figure 3

Photo 1

Photo 2

CONCLUSIONS

The hill slope treatments used on the Cerro Grande Fire reduced on-site runoff and soil erosion. Treatments such as straw mulch, straw wattles, log erosion barriers, and contour felling were most effective right after the fire and appear to lose effectiveness through time. The seeding treatment was generally ineffective except in localized areas.

Unfortunately, these treatments had limited effect on protecting downstream resources. Despite extensive (and expensive) hill slope treatments, watersheds can still discharge flood flows orders of magnitude greater than preburn flows (Photo 3). Depending on the resources at risk, in-channel treatments may be necessary to control flood flows.

Photo 3

LITERATURE CITED

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ACKNOWLEDGEMENTS

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